Description of four newly discovered Thylacine pouch young and a comparison with Boardman (1945)

Stephen R. Sleightholme[1], **Jan Robovský**[2] **and Vladimír Vohralík**[3]

[1] Project Director - International Thylacine Specimen Database (ITSD), 26 Bitham Mill, Westbury, BA13 3DJ, UK.

[2] Department of Zoology, Faculty of Science, University of South Bohemia, Branišovská 31, CZ-370 05 České Budějovice, Czech Republic.

[3] Department of Zoology, Faculty of Science, Charles University, Viničná 7, CZ-12844, Praha 2, Czech Republic.

Corresponding email: DrSleightholme@aol.com

ABSTRACT

Some of the rarest of all thylacine specimens are the alcohol preserved pouch young of which 10 specimens were known to exist. In November 2011, a remarkable discovery was made in the zoological collection of Charles University in the Czech Republic of four pouch young at an early stage in their development. These specimens are described for the first time in this paper.

Key words: Thylacine, *Thylacinus cynocephalus,* Pouch young, International Thylacine Specimen Database (ITSD).

DOI: http://dx.doi.org/10.7882/AZ.2012.027

Introduction

The Thylacine or Tasmanian tiger (*Thylacinus cynocephalus)* is the largest marsupial carnivore to have existed into modern times. The last known captive specimen, a male (Sleightholme, 2011), died at the Beaumaris Zoo on the Queens Domain in Hobart on the night of the 7th September 1936.

There are a total of twelve alcohol preserved pouch young listed within the 4th revision of the International Thylacine Specimen Database [ITSD]. Two of these specimens, registered in the catalogue of the Museum of Vertebrates at Cornell University as "*foetal specimens*" [CU75 & CU77], could not be located (17/5/2010) and are now presumed to no longer exist. Of the ten surviving pouch young, a male specimen in the collection of the National Museum of Victoria [NMV C5754] was sectioned for microscopy in 1994 by Professor Milan Klima of the Institute of Anatomy, Johann Wolfgang Goethe University, Frankfurt, and remains in the museum's collection as a series of microscopy slides (Fig. 1).

Of the nine whole specimens, three are in the collection of the National Museum of Victoria [NMV] in Melbourne [C5755, C5756, C5757] (Figs. 2-4), one in the Australian Museum [AMS] in Sydney [P762] (Fig. 5), and five in the Tasmanian Museum & Art Gallery [TMAG] in Hobart [A930, A931, A932, A933, A934]. Four of these specimens are males, four are females, with one [TMAG A933] where the sex is yet to be determined.

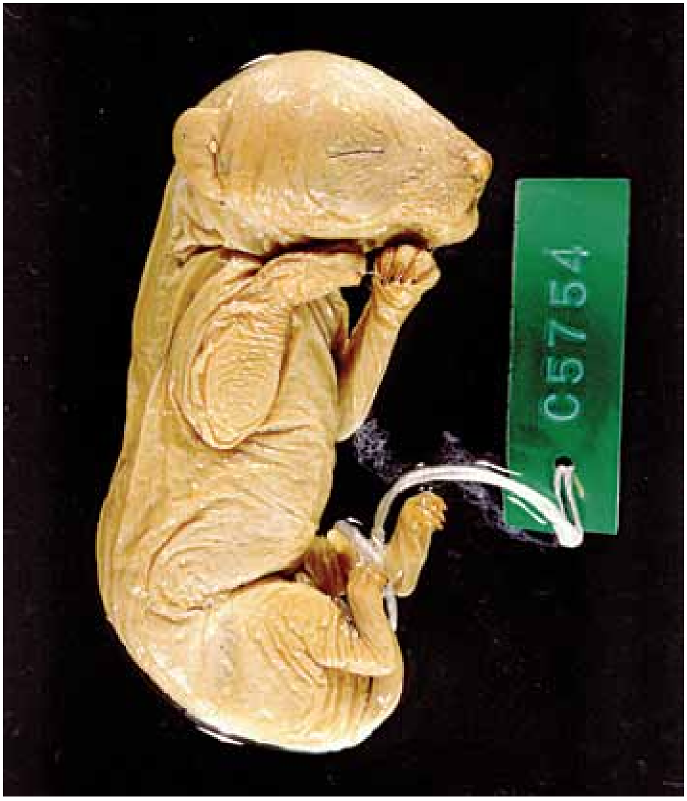

Figure 1. Thylacine pouch young [NMV C5754 (♂)] (Sectioned 1994). Courtesy: National Museum of Victoria. Photo, Prof. Dr. Heinz Moeller.

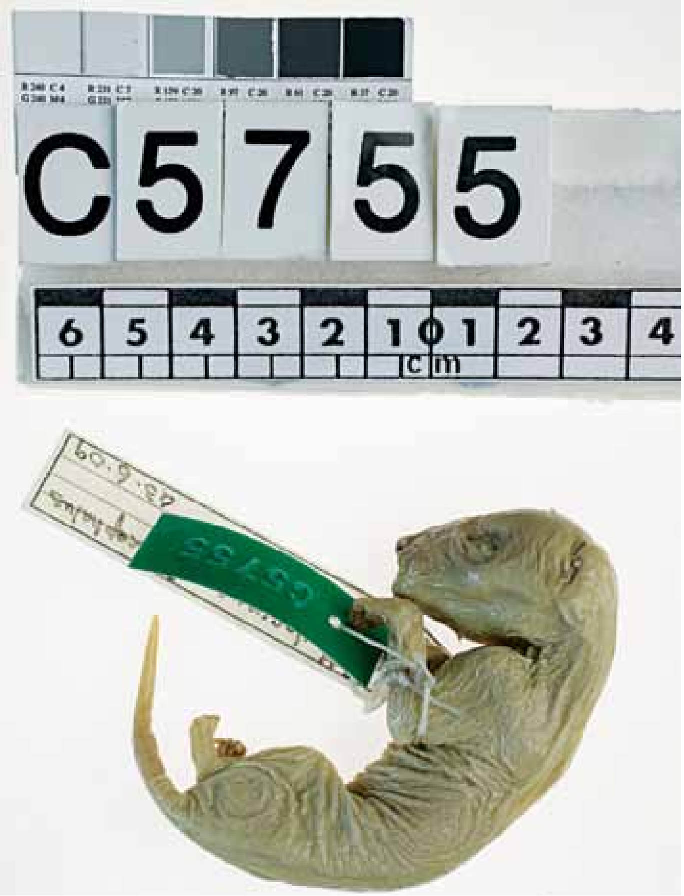
C5755
6 5 4 3 2 1 0 1 2 3 4
cm
23-6-09
C5755

Figure 2.

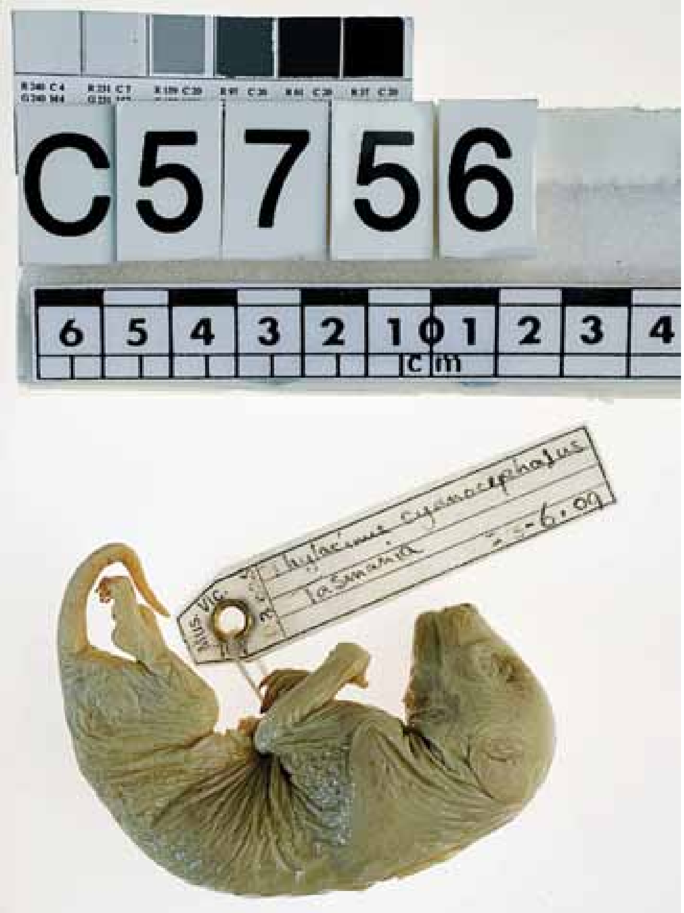
C5756
6 5 4 3 2 1 0 1 2 3 4
cm
Mus. Vic.
Thylacinus cyanocephalus
Tasmania
23-6-09

Figure 3.

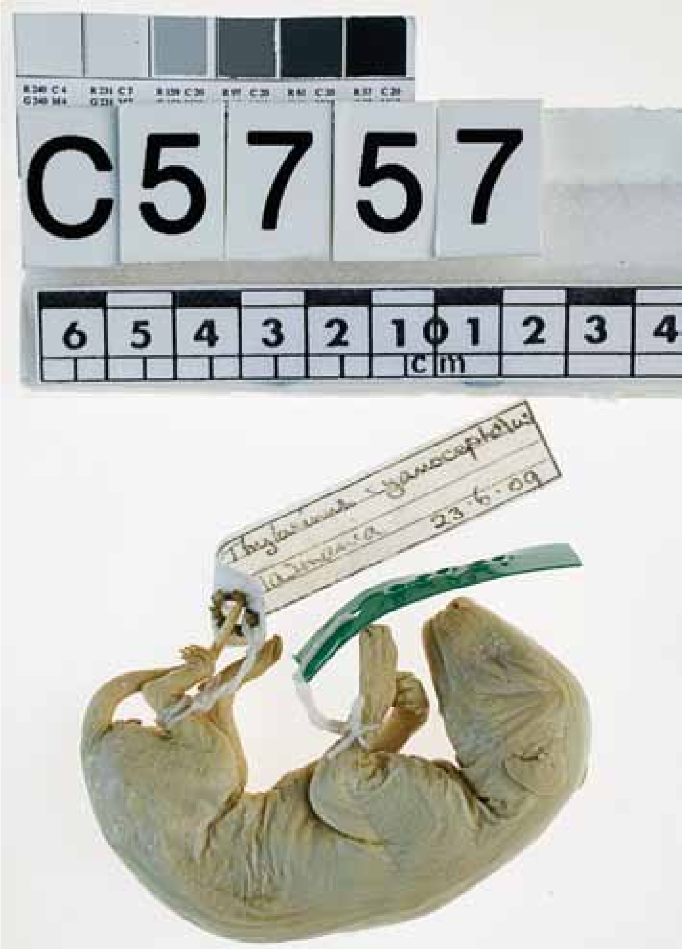
C5757
6 5 4 3 2 1 0 1 2 3 4
cm
Thylacinus cyanocephalus
Tasmania
23-6-09

Figure 4.

Figures 2-4. Thylacine pouch young [NMV: C5755 (♂), C5756 (♀), C5757 (♀)].

Photos courtesy National Museum of Victoria.

The four NMV pouch young together with their mother were obtained as dead specimens from William M. McGowan, Superintendant of the Launceston City Park Zoo (1882-1937), on the 23rd June 1909. The AMS pouch specimen was obtained on a collecting trip to Tasmania in 1866 by George Masters, the museum's assistant curator (1864-1874). The TMAG pouch young were collected from different sources during the 1920s and early 1930s.

The only other pouch specimens known to exist were those in the collection of the Leeds City Museum [LCM] in the UK. The ITSD notes that the museum lost eight thylacine pouch young [LCM 1869.46] during a bombing raid in 1941. The specimens were presented to the museum in 1869 by Walter H. Gellibrand.

History

The four newly discovered thylacine pouch young (Figs. 6-9) are housed in the collection of the Department of Zoology (Faculty of Science) at Charles University in Prague. Charles University is the oldest and largest university in the Czech Republic. Founded in 1348, it was the first university in Central Europe, and is also considered the earliest German university. The collection of the Department of Zoology (acronym DZCU) was accumulated over many years. The thylacine specimens[1] are associated

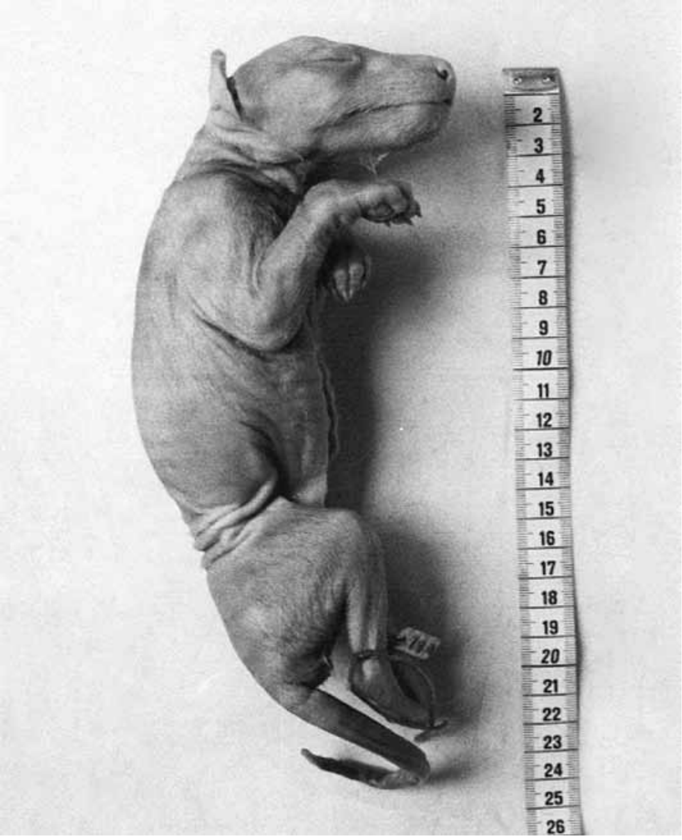

Figure 5. Thylacine pouch young [AMS P762 (♀)]. Courtesy: Australian Museum.

Photo, Prof. Dr. Heinz Moeller.

with the former Institute of Zoology of the German part of Charles University. The pouch young are the only known alcohol preserved specimens outside of Australia, and the earliest in terms of their morphological development.

Accession record

Four embryos are mentioned in an inventory book of this institution: "*Inventar des zoologischen Institutes der Deutschen Universität in Prag*", as four embryos in alcohol "*4 Embryonen in Sp(iritus)*" (inventory number 8021). The accession date is noted as being prior to 1897, but the identity of the collector[2] and locality of collection are unknown.

Storage & Labelling

The four pouch young are stored together in a glass storage jar measuring 21.5cm in height by 5cm in diameter and secured with an airtight seal (Fig. 10). The jar is labelled "*23/6*" and "*XLI-50e*" which indicates a position in the collection room and not the original inventory numbers. The seal has a paper label with the wording "*Thylacinus cynocephalus embrya*" (=*embryos in English*). The specimens are stored (probably) in pure alcohol, not formalin, and are fastened to a glass table via tied threads. They are numbered in sequence from the top of the storage jar as: n 1, 2, 3 and 4.

Description

The pouch young are preserved intact. With respect to body shape specimen 4 appears unnaturally stretched. This anomaly may be the result of its forced avulsion from the teat. The pouch young are naked and the facial vibrissae not yet apparent. The eye is at a very early stage in its development with no retinal pigment visible in the primordia. The eyelids are unopened. The external parts of the ears are absent. The parietal and occipital sutures are marked in specimens 1, 2 and 4, but indistinct in specimen 3. The lips are sealed laterally, with the mouth forming a circular aperture for its attachment to the teat. The definitive lip line is indicated by a shallow groove for most of its length. With reference to the development of the rhinarium, some walls around the nares are visible (under magnification) in specimen 1 and 2, with traces in specimen 4. In specimen 3, the nasal region is hidden. In common with all marsupial neonates, the forelimbs are mobile and well developed in relation to the hind limbs. The digits of the manus bear pointed claws, whereas on the pes, the claws have yet to form. Backbone segmentation is discernible, especially in the tail. Lateral compression in the flanks, and wrinkling of the skin in the rib region, is noticeable in all the pouch young. Residues of what may be extra embryonal membrane, or possibly released skin, are evident on the body of specimen 2, the abdomen of specimen 3, and the head and neck of specimen 4.

Photos: DZCU pouch young, (Figs. 6-7 Tereza Holicová, Figs. 8-9 Roman Hrdlička). Courtesy: Dept. Zoology Charles University.

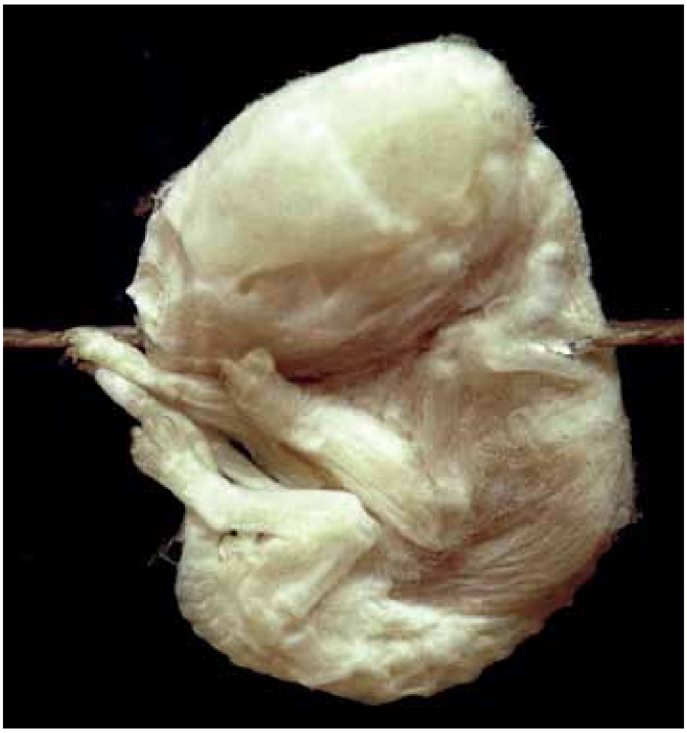

Figure 6. Specimen DZCU 8021[1]

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[1] An additional specimen of *Thylacinus* is also mentioned in this inventory book under inventory number 8020 as a non-liquid (=dry) specimen. Unfortunately, this specimen (probably a skull), could not be located in the collection as of 24.4.2012.

[2] Although the identity of the collector is unknown, it was possibly Václav Frič who had an established natural history business in Prague (Reiling and Spunarová (2005)).

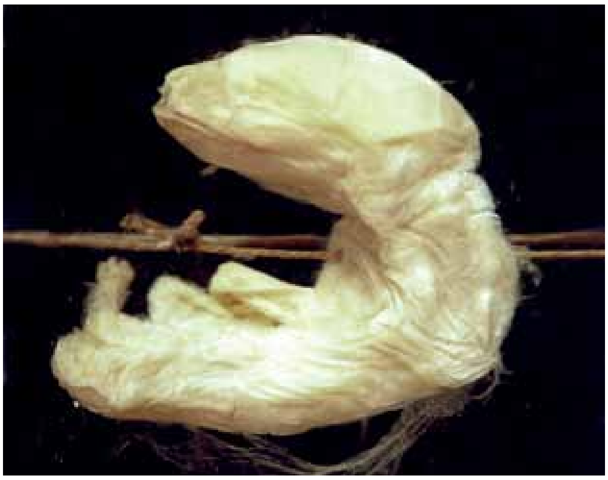

Figure 7. Specimen DZCU 8021[2]

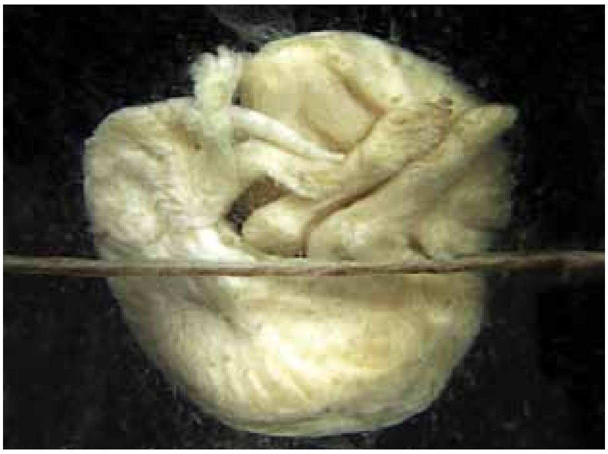

Figure 8. Specimen DZCU 8021[3]

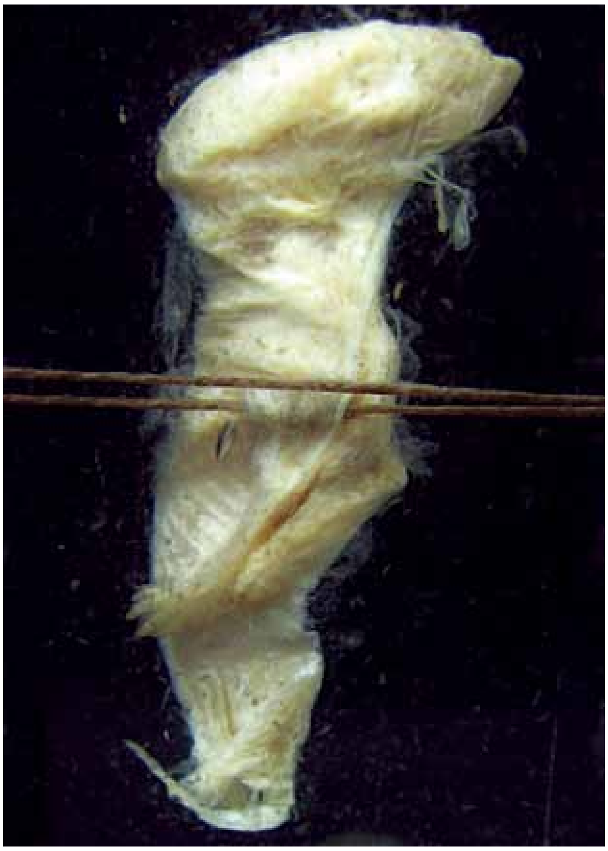

Figure 9. Specimen DZCU 8021[4]

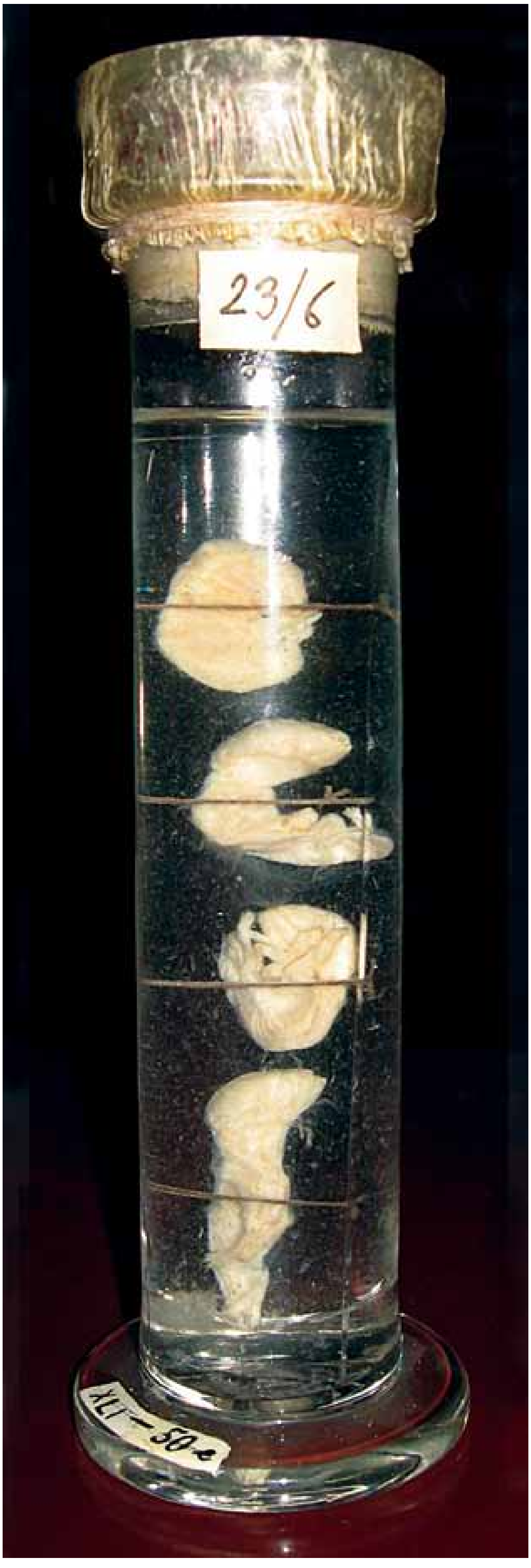

Figure 10. Thylacine pouch young [DZCU 8021:1-4]. Courtesy: Dept. Zoology Charles University.

Photo, Jan Robovský.

Body Measurements

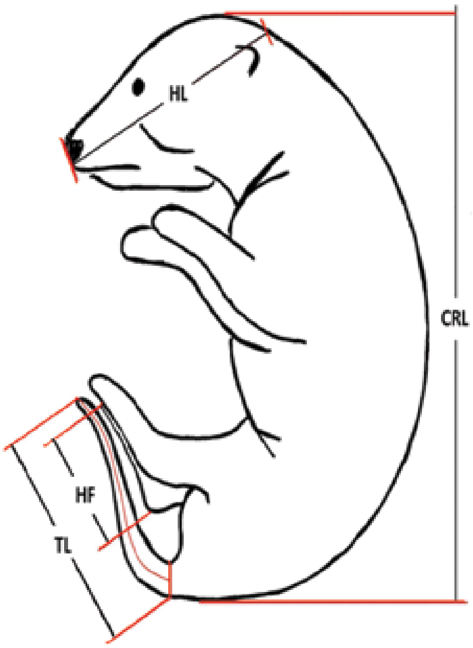

Figure 11. Points of measurement of DZCU pouch young after Ansell (1965). **CRL:** crown/rump length, **HL**: head length, **HF**: hind foot, **TL:** tail length. Illustration: Nicholas Ayliffe (*after Moeller*).

Table 1. Body measurements (mm) of DZCU pouch young after Ansell (1965) [with tail length]. §: The braincase is widened, but the head length is shortened. †: Specimen 4 is unnaturally stretched. All given measurements are near approximations, as the pouch young were not removed from their storage jar.

DZCU	CRL	HL	HF	TL
8021 [1]	24	17	3	7
8021 [2]	26	18	4	8
8021 [3]	27	14§	3	15
8021 [4]	38†	18	2	10
$\bar{x}$ (1-4)	29	17	3	10
$\bar{x}$ (1-3)	26	–	–	–
$\bar{x}$ (1,2,4)	–	18	–	–

Determination of Sex

Sex was determined (under magnification) by external examination. The sex of only one specimen could be established with any degree of accuracy; specimen 1 is a male. Specimen 2 is possibly female, as is specimen 3, but with a lesser degree of certainty. Specimen 4 is possibly a male.

Discussion

Marsupials are born in an embryonic state in comparison to their eutherian counterparts. The gestation period is relatively short, as their young complete by far the greater part of their development externally within the mother's pouch or marsupium. Few marsupials have a gestation period longer than their oestrous cycle (Merchant 1983). The gestation period for the thylacine is unknown. Educated comparisons have been made with the thylacines smaller cousins the tiger or spotted-tailed quoll (*Dasyurus maculatus*), and the Tasmanian devil (*Sarcophilus harrisii*), with estimates varying from 21 days (Le Souef & Burrell 1926, p.319; Paddle 2000, p.228) to 35 days (Guiler 1985, pp.73-74; Dixon, 1989, p.14; Guiler & Godard 1998, p.20). The female thylacine possessed four teats, so the DZCU pups represent a full complement of young. The external morphology of thylacine pouch young was first described by Boardman (1945). Boardman presents a comparison of the external features (*hair, pigmentation, hair tracks, facial vibrissae, lips and oral fissure, rhinarium, eye, external ear, feet and marsupium*) of the thylacine pouch specimen in the AMS collection [P762] with the thylacine pouch specimens (litter of 4) in the NMV collection [C5754, C5755, C5756, C5757]. These are the NM litter referred to by Boardman [R3025, R3026, R3027, R3028], which have since been re-catalogued. Boardman provided the CRL (crown rump length) for the NMV pouch young and the DCL (dorsal curvature length) plus tail length (TL) for the AMS specimen. He gives the length of head and body of the AMS specimen as 288mm (+ tail 119mm). The CRL of the AMS specimen, as determined from Moeller's photograph (Fig. 5), is 218mm. Boardman's CRL for the pouch young of the NMV litter is given as 75mm (*approximate*)[3]. With a mean CRL of 26mm [DZCU 8021:1-3], the Charles University litter are the youngest thylacine pouch young known to exist, with an estimated age, based on the CRL measure of the NMV pups, of ≤ 2 weeks. A comparison of four morphometric parameters (CRL, HL, HF and TL) for the DZCU, NMV and AMS pouch young is illustrated in Fig. 12.

The measures provided for the DZCU pouch young are based on the mean CRL for specimens 1-3 and the mean HL for specimens 1, 2 and 4. The NMV measures were obtained from specimen C5757 (*Boardman R3028*). The AMS measures (CRL, HL & HF) were obtained from Moeller's photograph of the specimen (Fig. 5), and the TL is that quoted by Boardman. An illustration (arranged to scale) of the comparative CRL between the DZCU, NMV and AMS pouch young is given in Fig. 13.

Professor Heinz Moeller, former Director of the Zoological Museum and Department of Comparative Morphology of Vertebrates at the University of Heidelberg, provided an "*estimate of age*", based on x-ray analysis of the skull and dentition, of around 3 months for the AMS specimen, and 1 month for the NMV litter [letter 19/05/2007].

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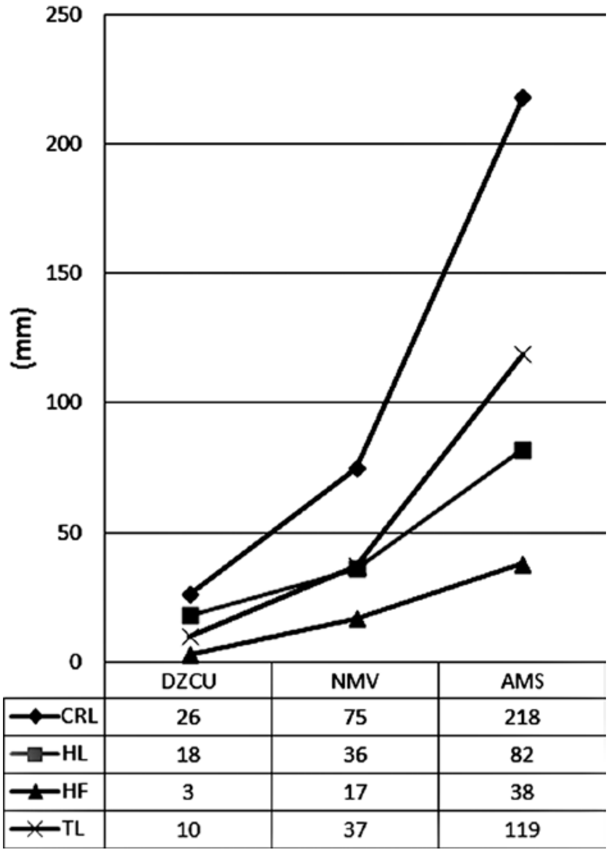
[3] The NMV litter were remeasured at the museum on the 24 March 1992. The measurements recorded were as follows: C5754 (♂) 77.8mm GL; 34mm HL – C5755 (♂) 74.7mm GL; 33.6mm HL – C5756 (♀) 71.9mm GL; 33.1 HL – C5757 (♀) 74.2mm GL; 33.6mm HL. Where GL = greatest length of head and body excluding the tail and HL = head length. The wet weight (in alcohol) was also noted for C5754 at 27.5g and for C5757 at 25.1g



	DZCU	NMV	AMS
◆ CRL	26	75	218
■ HL	18	36	82
▲ HF	3	17	38
✕ TL	10	37	119

Figure 12. A comparison of four morphometric parameters (mm) for the Charles University [DZCU], National Museum of Victoria [NMV], and Australian Museum [AMS] thylacine pouch young.

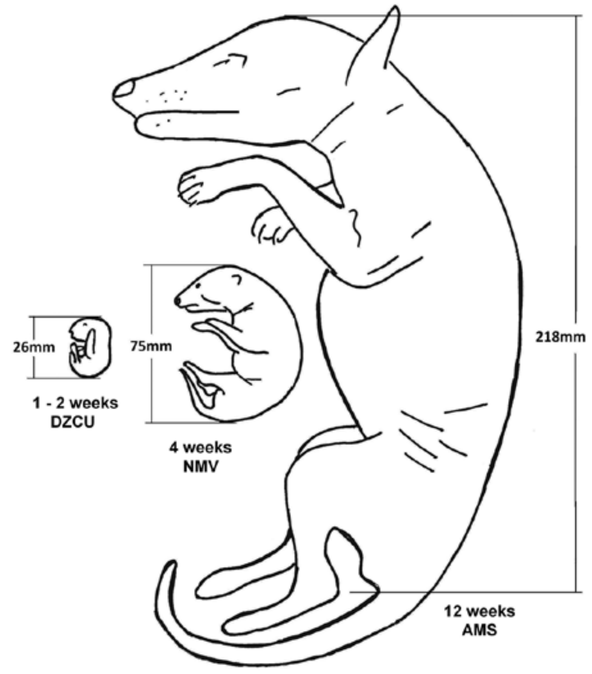


Figure 13. Comparative CRL of the Charles University [DZCU], National Museum of Victoria [NMV], and Australian Museum [AMS] thylacine pouch young (*arranged to scale*). Illustration: Nicholas Ayliffe (*after Moeller*).

Confirmation of the body length of the pouch young just prior to their emergence from the pouch can be found in an article in the Star newspaper dated the 29th December 1862. The newspaper reports on the source of a thylacine family group that were sent to the London Zoo by Ronald Gunn[4]. The report gives a brief description of one of the litter together with its length ("*snout to the root of the tail*") at 9 inches (229mm):

> "*The creature carries in her marsupial pouch three cubs attached to their parent in the manner peculiar to animals of their class, and has just lost another on Friday evening, which is now in the possession of R. Gunn, Esq. This cub is about nine inches in length, from the snout to the root of the tail; is well furnished with hair, and resembles its dam in colour. The mother was captured some three months since, in a snare; at Piper's river, by a son of Mr. Thomas Hurst, a farmer, residing in that district, and has since been kept upon a chain like a dog*".

This historical account appears to broadly support Moeller's age estimation for the AMS specimen.

Developmental comparisons have been made in the past with the Tasmanian devil (*Sarcophilus harrisii*) with an extrapolated pouch period for the thylacine of around 130-140 days (Guiler 1985, p.74, Guiler & Godard 1998, p.21). A shorter pouch period of 3 months, more akin to that of the tiger or spotted-tailed quoll (*Dasyurus maculatus*), has been cited by Le Souef & Burrell (1926, p.319), Dixon (1989, p.14), and Paddle (2000, pp.224-233). Evidence to support the shorter pouch period can also be found in contemporary newspaper reports: *Adelaide Advertiser* (17/11/1934, p.8), *The Queenslander* (25/2/1932, p.43), *Cairns Post* (19/5/1938, p.11), *West Australian* (24/12/1948, p.15), and the *Brisbane Courier* (9/7/1932, p.19).

Thylacine young left the pouch permanently, only returning to suckle, at around 16 weeks of age. This developmental transition was confirmed by observations of a captive female and her three offspring on route to the National Zoo in Washington D.C. The pouch young were born in early April 1902 and were completely independent by early August of that year. They were noted as "*playing in the box all day*" by A.C. Robison the dealer in charge of their import in a letter to Dr. Frank Baker the Superintendant of the National Zoo (Robison, letter, 26/8/1902, Smithsonian Archives Box 94).

Thylacine young were not fully weaned until at least 7 months of age as noted in an article in the Mercury newspaper of the 12th Feb 1924:

> "*Tiger Family at Zoo - A highly interesting addition, in the shape of a family of Tasmanian tigers been made to the Beaumaris Zoo this week. This comprises a female adult and three young ones, about seven months old, who come from the rough and heavily timbered country in the Tyenna Valley. When captured the young were found in*

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[4] Gunn hand reared the thylacine litter prior to their departure for London. Two of the litter died in transit. The mother and surviving male were placed on display at the London Zoo on the 2nd May 1863.

> *their mother's pouch, being then only a few weeks old, and have been successfully reared in captivity for some six months, when they were handed over to the City Council entirely devoid of ferocity, but playful and sufficiently tame to feed from their keeper's hand, as well as handsomely marked with brown and black, the little ones are sure to attract considerable attention by visitors to the zoo for the next few weeks. Although given a supply of chopped up meat, they are not altogether at a stage when they are independent of their maternal diet".*

Conclusion

The DZCU litter constitutes the single most important discovery to date in the development of the International Thylacine Specimen Database [ITSD], providing researchers with a valuable insight into the early pouch life of the thylacine. A more detailed examination of the pouch young is warranted if at some future point in time they are removed from their storage jar. This was not undertaken for the preliminary description for fear of unnecessarily contaminating the specimens.

Acknowledgements

The authors would like to thank Tereza Holicová and Roman Hrdlička for their help with photographing the specimens, Nicholas Ayliffe for his illustrations (*after Moeller*), Roman Fuchs for his remark about a record of a thylacine skull in the zoological collection of Charles University that directly led to the discovery of the thylacine pouch young and Olga Šimková who helped to recover the specimens. The authors would like to thank Mike Archer of the University of New South Wales and Colin Groves of the Australian National University in Canberra, for their review and comments on the manuscript, and Cameron Campbell, curator of the online Thylacine Museum[5], for his critique of the final draft. The second author was supported by grant of the Ministry of Education, Youth and Sports of the Czech Republic N. 6007665801, the third author by grant N. 0021620828.

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[5] http://www.naturalworlds.org/thylacine